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MONTHLY
MICROCLIMATIC SUMMARY

JULY 1967

ENVIRONMENTAL DATA BASE
FOR REGIONAL STUDIES IN THE HUMID TROPICS

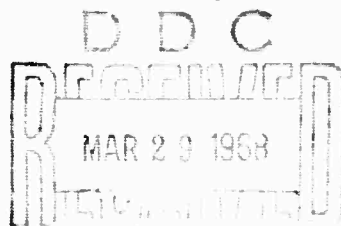
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Fort Clayton, Canal Zone

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MONTHLY
MICROCLIMATIC SUMMARY

JULY 1967

Prepared by

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USATECOM Project No. 9-4-0013-01

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MONTHLY MICROCLIMATIC SUMMARY

Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N, 79° 33'W
Chiva Chiva	09° 01'N, 79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semiannual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

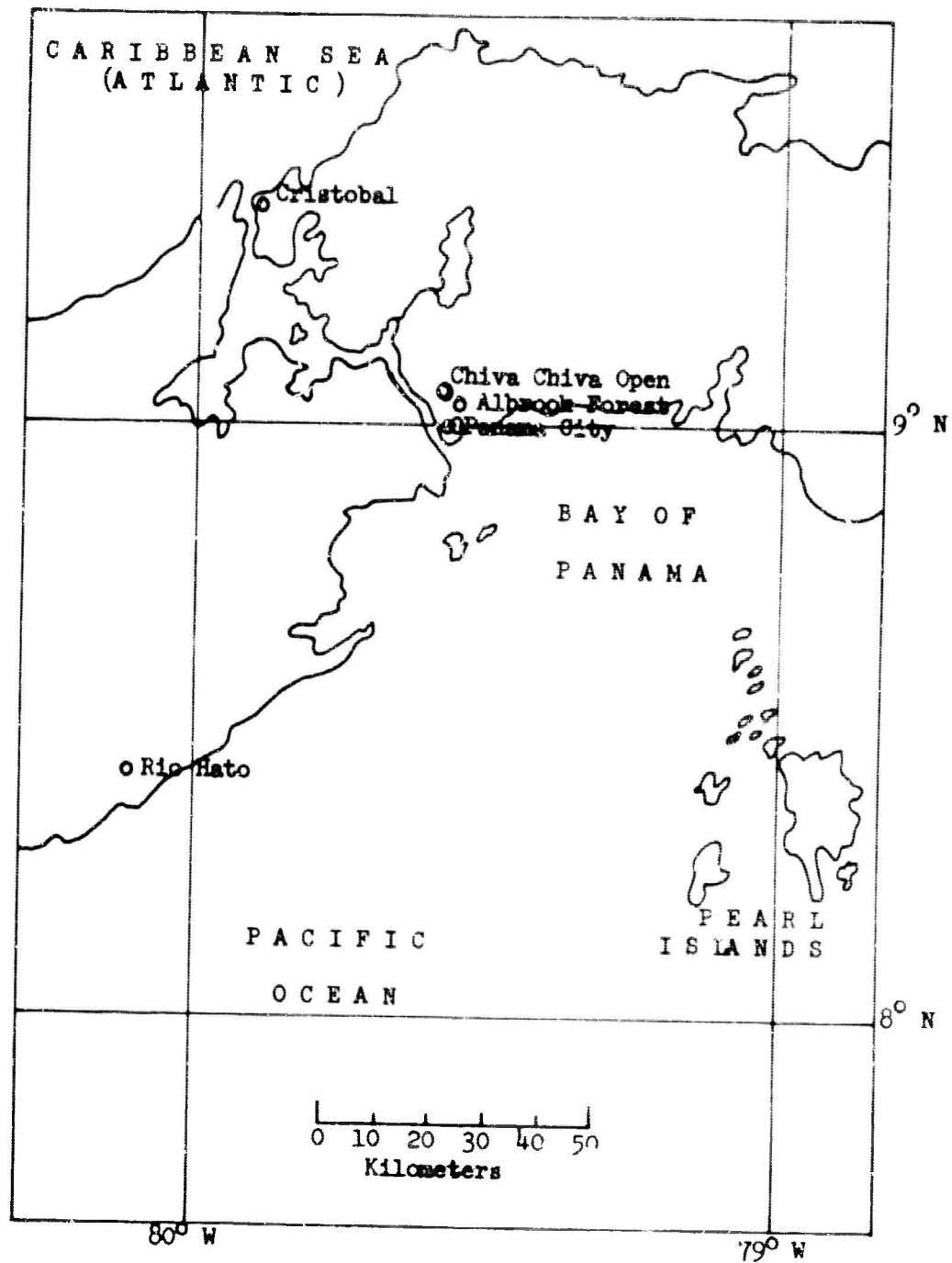


FIGURE 1. LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element	Height (meters)										Frequency
	Sfc	0.5	1.0	2.0	4.0	8.0	13.5	26.5	28.5	46.0	
<u>Temperature:</u>											
Dry Bulb	-	1	1	1	1	-	1	1	-	1	Hourly*/Continuously
Wet Bulb	-	1	-	1	1	-	-	-	-	-	Hourly*/Continuously
Grass Minimum	3	-	-	-	-	-	-	-	-	-	Once Daily
<u>WBGT Index</u>											
	-	-	1	-	-	-	-	-	-	-	Hourly (0600-1900 EST)
<u>Relative Humidity</u>											
	-	1	1	1	1	-	1	1	-	1	Hourly*/Continuously
<u>Barometric Pressure</u>											
	-	-	1	-	-	-	-	-	-	-	Continuously
<u>Evaporation</u>											
	-	1	-	-	-	-	2	2	-	2	Once Daily
<u>Precipitation:</u>											
Recording Gage	-	-	1	-	-	-	-	-	-	2	Continuously
Manual Gage	-	-	2	-	-	-	-	-	-	-	4 Times Daily
Stem Flow	-	-	2	-	-	-	-	-	-	-	4 Times Daily
<u>Wind:</u>											
Direction	-	-	-	-	1	-	-	1	-	1	Continuously
Speed	-	-	-	3**	1	-	3**	1	-	1	Hourly**/Continuously

* Observations made with sling psychrometer when recorders are inoperative.

** Hourly

Instrument descriptions are contained in the Environmental Data Base semiannual reports.

1. Albrook and Chiva Chiva
2. Albrook only
3. Chiva Chiva only

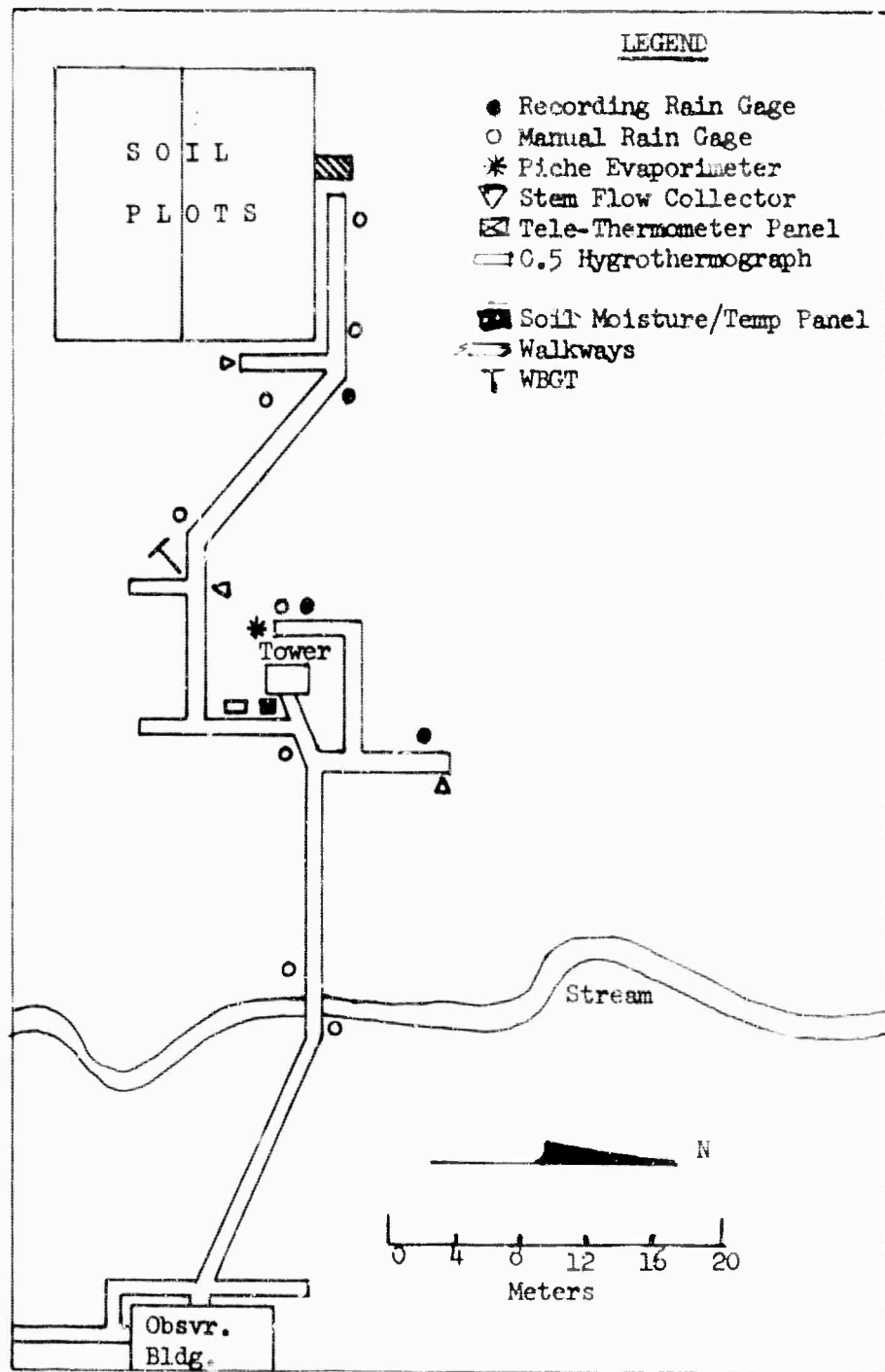


FIGURE 3. ALBROOK FOREST SITE, GENERALIZED PLOT

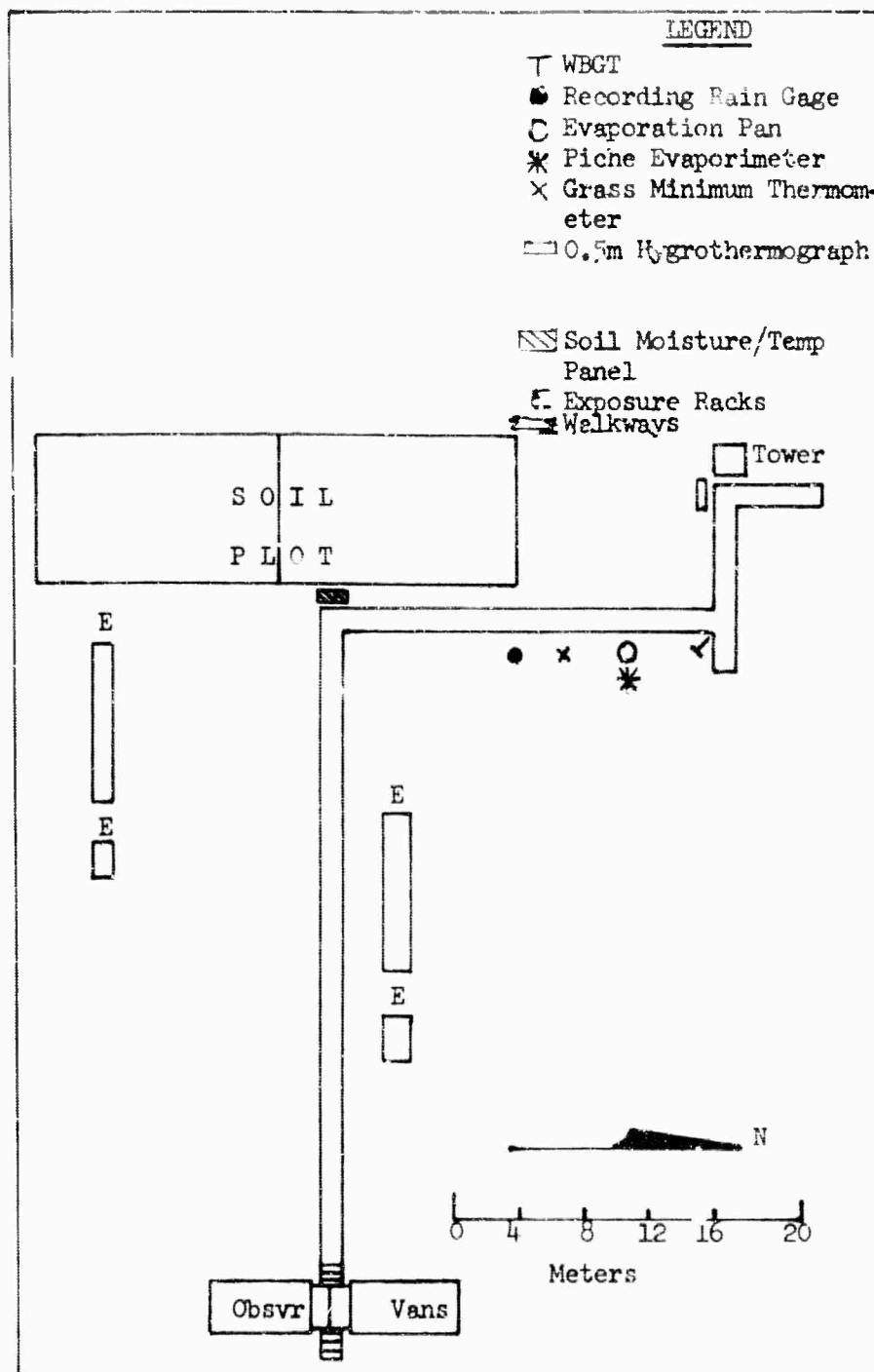


FIGURE 4. CHIVA CHIVA OPEN, GENERALIZED PLOT

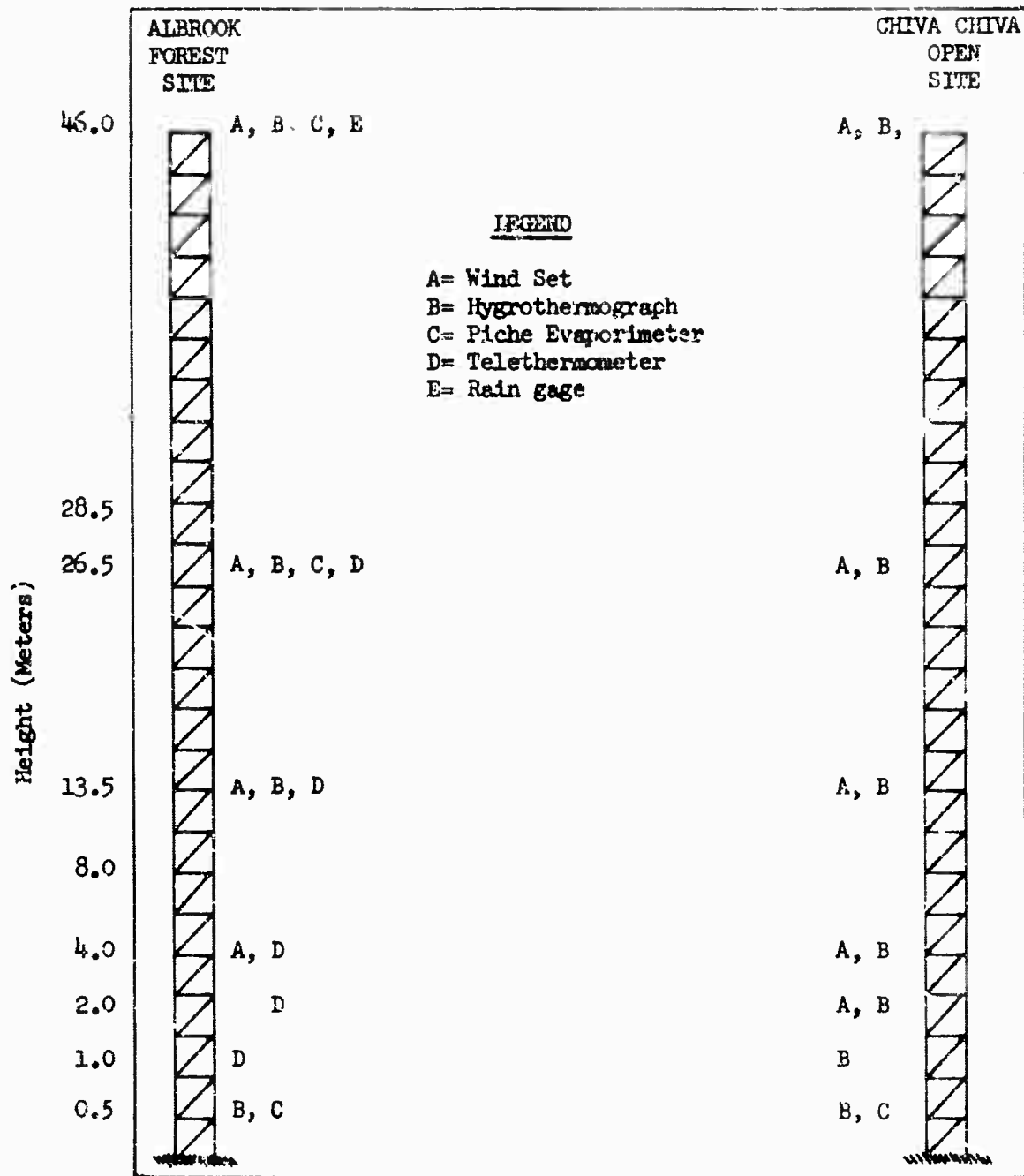


FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Ranges of Air Temperature by Hour (°F)																								Monthly Summary*	
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albrook (Forest site)	46.0 m	3.2	3.5	4.1	4.1	3.4	4.6	5.5	7.4	11.2	12.6	10.5	11.5	12.2	14.3	14.7	12.3	10.9	10.1	6.4	5.5	5.3	4.4	4.1	4.5		
	28.5 m								This level was not instrumented for air temperature at this time																		
	26.5 m		3.8	3.7	3.5	3.7	3.5	5.7	8.1	11.8	11.6	9.5	12.0	10.7	13.5	15.1	14.2	14.4	12.5	8.4	5.9	4.5	4.6	4.0	4.5		
	22.5 m	4.4	4.2	4.5	4.5	4.6	5.0	5.7	6.7	10.5	9.2	11.5	11.5	10.8	13.3	13.6	13.1	11.0	9.6	9.1	6.4	5.3	5.0	4.2	4.5		
	8.0 m								This level was not instrumented for air temperature at this time																		
	4.0 m	4.9	5.2	3.9	3.5	4.1	5.2	5.8	7.6	9.6	8.9	11.1	11.1	11.4	13.1	13.1	11.4	8.7	7.8	6.7	6.1	5.3	5.5	5.3	5.5		
	2.0 m	4.9	5.2	3.9	3.5	4.1	5.2	5.8	6.5	9.0	8.2	11.0	11.0	11.0	12.1	13.1	10.6	7.9	7.7	6.5	6.2	5.2	5.3	4.8	4.8		
1.0 m	5.2	5.0	3.5	3.7	4.0	4.8	5.2	5.5	8.8	7.7	9.5	10.2	9.7	12.0	12.0	10.3	8.2	7.7	6.6	6.4	5.6	5.5	4.5	4.7			
0.5 m	4.3	3.8	3.7	3.8	3.9	4.2	4.4	5.9	7.8	7.6	8.7	9.2	9.0	12.3	10.5	9.9	8.5	7.2	6.6	5.2	5.2	4.6	5.0	4.1			

* No monthly summary was computed for the ranges.

China Chiva (Open site)	46.0 m	4.8	3.6	4.7	3.7	4.3	5.6	7.7	12.3	16.6	13.3	11.9	11.4	14.0	14.1	13.6	11.1	10.3	8.9	7.5	6.5	5.1	4.9	4.9	4.7		
	28.5 m								This level was not instrumented for air temperature at this time																		
	26.5 m	4.0	3.7	4.4	4.5	4.6	6.0	9.3	12.7	17.6	11.9	11.4	11.0	13.3	14.4	13.6	11.7	10.7	8.8	7.0	6.7	5.6	5.1	4.9	4.8		
	13.5 m	3.8	4.2	4.2	4.2	4.4	5.8	9.4	13.4	17.3	12.0	11.3	11.0	13.7	15.0	14.1	12.3	10.6	8.6	6.9	6.5	5.3	5.4	4.8	4.1		
	1.0 m								This level was not instrumented for air temperature at this time																		
	4.0 m	5.0	5.8	6.3	5.8	6.6	6.4	7.1	10.9	15.3	13.0	13.1	13.5	12.2	12.1	15.0	15.6	11.3	8.5	6.4	5.7	5.6	5.7	5.6	6.7		
	2.0 m	6.2	5.5	5.5	5.5	5.5	5.5	6.8	10.5	16.1	13.5	13.5	14.2	13.0	13.6	16.4	14.1	12.9	8.9	5.7	6.4	5.3	5.3	5.2	6.3		
	1.0 m	5.8	5.0	5.9	6.0	6.1	6.1	7.1	12.1	15.6	18.1	15.8	17.4	14.5	18.9	16.3	15.0	13.9	9.8	5.9	6.3	5.5	6.5	6.0	6.1		
	0.5 m	5.5	5.0	5.5	5.3	5.8	5.8	7.2	11.8	15.7	14.8	15.6	17.1	15.0	18.2	16.0	15.0	14.0	9.6	6.0	6.4	5.5	6.2	5.5	6.2		

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Means ° Air Temperature by Hour (°F)																								Monthly Summary																				
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of obs.	Min.	Mean	Max.																	
Albrook (Forest site)	46.0 m	75.3	75.2	75.1	75.0	74.8	74.5	74.8	76.0	78.1	80.3	81.9	83.1	83.3	82.5	81.4	79.1	78.3	77.5	76.5	76.1	75.9	75.8	75.7	75.6	740	71.2	77.6	88.5																	
	28.5 m									This level was not instrumented for air temperature at this time																																				
	25.5 m	75.0	74.8	74.6	74.5	74.3	74.2	74.6	76.0	78.1	80.4	82.1	83.4	83.4	82.7	81.7	79.6	78.7	77.6	76.4	75.8	75.6	75.4	75.3	75.0	744	71.0	77.5	88.8																	
	13.5 m	75.0	74.9	74.7	74.4	74.2	74.0	74.2	73.5	77.2	78.9	80.4	81.3	81.6	81.4	80.8	79.2	78.3	77.4	76.5	76.0	75.7	75.5	75.4	75.2	734	70.9	77.0	86.8																	
	8.0 m									This level was not instrumented for air temperature at this time																																				
	4.0 m	74.6	74.4	74.3	74.1	73.9	73.7	74.3	76.1	77.6	79.0	80.1	81.1	81.1	81.0	80.2	78.6	77.7	76.9	75.9	75.6	75.3	75.2	75.1	74.9	744	70.5	76.7	86.8																	
	2.0 m	74.6	74.4	74.2	74.1	73.9	73.7	74.2	75.9	77.3	78.7	79.9	80.9	80.8	80.8	80.3	78.4	77.6	76.8	75.9	75.7	75.4	75.2	75.0	74.8	744	71.0	76.6	86.3																	
	1.0 m	74.7	74.5	74.3	74.2	73.9	73.7	74.3	75.8	77.2	78.5	79.6	80.6	80.8	80.7	80.1	78.4	77.6	76.8	76.0	75.7	75.4	75.3	75.2	75.0	744	70.8	76.6	85.8																	
0.5 m	75.1	74.9	74.8	74.7	74.5	74.4	74.5	75.7	77.0	78.3	79.5	80.4	80.6	80.7	80.2	78.9	78.2	77.5	76.6	76.1	76.0	75.7	75.6	75.4	743	72.0	76.9	86.5																		

46.0 m	75.3	75.1	75.0	74.9	74.7	74.6	75.7	78.1	80.3	81.8	87.7	83.7	83.4	82.0	80.7	79.2	78.1	77.3	76.5	76.3	76.1	75.9	75.8	75.5	739	71.6	77.9	88.8
28.5 m	This level was not instrumented for air temperature at this time																											
26.5 m	75.2	75.0	74.9	74.8	74.6	74.4	75.6	78.2	80.1	81.6	82.3	83.5	83.3	82.3	81.0	79.5	78.3	77.6	76.7	76.5	76.2	76.0	75.8	75.6	714	71.0	77.9	89.6
13.5 m	75.1	74.9	74.8	74.6	74.5	74.3	75.6	78.5	80.6	81.9	82.8	83.8	83.7	82.6	81.3	79.7	78.5	77.8	76.7	76.4	76.1	75.9	75.6	75.3	744	71.2	78.0	89.6
8.0 m	This level was not instrumented for air temperature at this time																											
4.0 m	74.7	74.3	74.2	74.0	73.9	73.8	75.0	77.7	79.7	81.7	83.0	84.5	84.7	83.8	82.1	80.4	79.2	78.2	77.0	76.7	76.4	76.0	75.4	75.1	738	70.2	78.0	89.8
2.0 m	74.6	74.2	74.1	73.9	73.8	73.6	74.9	77.6	79.9	82.1	83.5	85.0	85.2	84.3	82.6	80.6	79.3	78.2	76.9	76.5	76.3	75.8	75.2	74.9	738	70.9	78.0	91.1
1.0 m	74.5	74.2	74.1	73.7	73.6	73.3	75.1	78.0	80.5	82.8	84.1	85.7	85.0	83.9	82.5	80.4	79.1	77.9	76.4	76.0	75.8	75.3	75.1	74.9	741	70.2	78.0	93.2
0.5 m	74.4	74.0	74.0	73.6	73.6	73.3	75.0	78.1	80.7	83.2	84.7	86.4	85.6	84.2	82.6	80.5	79.2	77.9	76.5	76.1	75.8	75.2	75.1	74.7	741	70.3	78.1	92.9
China China (Open site)																												

JULY 1967

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SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure	Monthly Ranges of Relative Humidity by Hour (%)																								Monthly Summary*	
	Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22		23
Albrook (Forest site)	46.0 m	4	6	5	4	4	4	3	12	20	25	28	29	30	31	30	29	26	25	19	11	10	10	9	4	
	28. m																									
	26.5 m	12	10	12	11	11	10	10	15	16	25	21	22	21	32	33	32	28	22	16	12	12	11	10	11	
	13.5 m	9	9	10	8	6	6	6	10	12	20	25	30	33	35	37	34	31	31	28	22	16	13	12	11	
	8.0 m																									
	4.0 m	10	11	9	5	6	4	6	11	18	21	25	28	31	32	28	30	27	24	20	12	17	10	10	8	
	2.0 m	10	12	6	5	6	6	5	10	15	15	14	25	26	27	24	25	24	27	22	16	12	10	9	11	7
	1.0 m	8	8	6	6	5	4	4	4	7	11	13	20	25	31	24	20	21	25	20	14	12	10	10	11	9
	0.5 m	6	8	8	7	6	5	5	7	4	10	12	19	21	19	23	20	15	19	16	13	9	7	8	8	7

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)																									the ranges.									
46.0 m	9	9	9	8	8	8	9	22	26	23	27	25	27	28	33	29	23	22	16	12	7	10	10	9										
28.5 m																																		
26.5 m	8	9	8	7	8	7	10	22	32	24	26	29	30	32	37	32	27	23	15	10	8	9	8	8										
13.5 m	9	10	9	10	9	8	13	23	28	21	23	23	24	24	33	29	24	23	17	11	8	10	10	10										
8.0 m																																		
4.0 m	11	12	10	10	10	8	11	19	28	24	31	30	33	34	40	36	28	23	20	13	0	11	14	14										
2.0 m	10	10	10	8	8	7	10	17	30	25	31	29	35	34	38	35	29	23	13	12	11	9	11	9										
1.0 m	9	8	10	10	11	11	11	23	32	25	28	28	26	28	37	32	26	24	16	8	11	9	8	8										
0.5 m	10	9	8	12	13	13	10	19	27	30	35	38	34	38	38	36	29	27	14	13	11	12	20	20										

Chiva Chiva (Open site)

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Means ² of other Elements by Hour																								Monthly Summary			
Site	Code ¹	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Days	Min.	Mean	Max.
Albrook (Forest site)	WB (4.0 m)	73.9	73.8	73.7	73.7	73.5	73.3	73.9	75.0	75.7	76.6	77.2	77.5	77.8	77.5	77.2	76.2	75.8	75.2	74.7	74.7	74.5	74.5	74.4	74.2	744	70.4	75.2	81.2
	WB (2.0 m)	74.0	73.8	73.8	73.7	73.5	73.3	73.8	75.1	75.7	76.7	77.3	77.8	78.0	77.7	77.4	76.4	76.0	75.3	74.8	74.7	74.6	74.5	74.4	74.2	744	70.9	75.3	81.0
	WB (0.5 m)	74.5	74.3	74.2	74.1	73.9	73.8	73.9	75.0	75.9	76.7	77.5	78.0	78.5	78.3	78.0	77.1	76.6	76.1	75.5	75.2	75.1	74.9	74.8	74.7	742	70.8	75.7	81.4
	BP	.753	.738	.727	.722	.724	.729	.746	.758	.766	.773	.772	.762	.742	.724	.706	.698	.696	.702	.717	.736	.756	.766	.775	.767	744	.640	.740	.875
	P1	0.00	0.04	0.01	0.01	0.05	0.20	0.15	0.12	0.10	0.01	0.06	0.02	0.02	0.23	0.11	0.35	0.11	0.08	0.05	0.03	0.01	0.01	0.00	0.39	69	0.01	7.91	0.90
P2	0.00	0.01	0.02	0.00	0.03	0.32	0.26	0.07	0.06	0.04	0.05	0.01	0.04	0.38	0.06	0.40	0.08	0.02	0.00	0.01	0.00	0.00	0.00	0.22	37	0.01	4.76	0.69	
P3	0.00	0.05	0.00	0.00	0.03	0.20	0.25	0.06	0.11	0.03	0.09	0.00	0.00	0.77	0.05	0.48	0.34	0.06	0.00	0.00	0.00	0.00	0.00	0.50	25	0.01	4.99	0.77	
P4	0.00	0.02	0.00	0.00	0.00	0.03	0.21	0.27	0.22	0.07	0.04	0.02	0.00	0.00	1.20	0.14	0.47	0.21	0.03	0.01	0.00	0.00	0.01	0.25	41	0.01	7.97	1.20	

Chiva Chiva (Open site)	WB (4.0 m)	73.8	73.6	73.4	73.4	73.4	73.1	73.9	75.2	75.8	76.5	77.0	77.3	77.4	77.2	76.8	76.3	75.8	75.4	74.9	74.9	74.8	74.5	74.2	74.1	738	70.2	75.1	80.3
	WB (2.0 m)	73.7	73.5	73.4	73.3	73.2	73.1	74.0	75.4	76.2	77.0	77.6	78.0	73.1	77.8	77.2	76.5	75.9	75.4	74.9	74.8	74.7	74.5	74.1	74.0	738	70.3	75.2	81.5
	WB (0.5 m)	73.6	73.3	73.2	73.1	73.1	73.0	74.3	76.1	77.2	78.2	79.0	79.4	79.2	78.7	77.4	76.5	75.9	75.3	74.7	74.6	74.4	74.2	73.8	73.7	741	68.3	75.5	83.1
	BP	.849	.854	.923	.818	.818	.824	.838	.851	.864	.870	.870	.861	.840	.824	.807	.797	.795	.800	.814	.834	.852	.862	.870	.865	744	.740	.837	.950
	PS	0.09	0.00	0.00	0.03	0.09	0.44	0.23	0.25	0.07	0.02	0.07	0.05	0.26	0.79	0.06	0.35	0.06	0.02	0.02	0.00	0.00	0.00	0.05	0.11	57	0.01	10.55	1.66

¹ WB - Wet bulb temperature (°F)
BP - Barometric pressure (in. of Hg minus 29.0)
PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P3 - Precipitation under drip canopy (in.)
P4 - Precipitation under open canopy (in.)

² Monthly means of precipitation are computed for precipitation days. Precipitation totals are substituted for the mean in the monthly summary.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Ranges ² of other Elements by Hour																								Monthly Summary*	
Site	Code	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albrook (Forest site)	WB (4.0 m)	4.3	4.2	3.3	3.5	3.9	4.9	5.6	6.2	7.0	6.5	6.3	6.0	7.2	7.7	6.5	5.8	4.5	4.3	4.8	4.3	4.2	4.5	4.6	4.7		
	WB (2.0 m)	4.2	4.1	3.7	3.4	3.8	5.0	5.1	6.0	7.3	6.3	6.2	6.0	6.6	7.7	7.7	5.7	5.1	5.5	4.4	4.1	4.1	4.1	4.4	4.1	4.5	
	WB (0.5 m)	3.7	3.6	3.4	3.7	3.8	4.1	4.8	6.0	7.2	6.4	5.8	5.8	4.9	7.2	6.9	6.7	5.6	5.8	4.4	4.4	4.1	4.0	4.1	3.6		
	BP	.120	.125	.135	.140	.120	.145	.160	.170	.140	.130	.135	.135	.140	.140	.140	.135	.120	.125	.110	.115	.120	.125	.115	.130		
	P1	0.00	0.05	0.00	0.00	0.05	0.51	0.35	0.12	0.22	0.01	0.02	0.00	0.02	0.06	0.19	0.86	0.26	0.19	0.13	0.03	0.00	0.00	0.00	0.00		
	P2	0.00	0.00	0.00	0.00	0.02	0.54	0.19	0.13	0.09	0.00	0.00	0.00	0.00	0.33	0.01	0.68	0.13	0.02	0.00	0.00	0.00	0.00	0.00	0.00		
Chiva Chiva (Open site)	WB (4.0 m)	5.3	5.1	4.6	5.1	4.9	5.2	5.8	7.5	8.7	7.3	6.1	5.8	6.1	5.2	6.4	7.1	6.2	5.3	4.6	4.4	4.2	3.6	4.3	4.9		
	WB (2.0 m)	5.0	4.8	4.4	4.6	4.6	5.2	5.7	7.7	9.1	7.8	6.6	6.0	7.3	5.4	6.9	7.1	6.6	5.1	4.6	3.9	3.9	3.8	4.1	4.8		
	WB (0.5 m)	5.2	4.7	4.7	5.0	6.0	9.5	7.5	8.4	9.0	8.9	8.2	7.7	7.5	9.6	7.5	7.2	7.8	4.7	4.5	4.9	3.7	5.0	7.5	8.5		
	BP	.125	.120	.125	.135	.130	.125	.155	.130	.125	.130	.135	.135	.135	.135	.135	.130	.130	.130	.120	.125	.120	.120	.115	.115		
	P1	0.00	0.00	0.00	0.04	0.20	0.23	0.46	0.45	0.11	0.01	0.11	0.07	0.74	1.65	0.12	1.42	0.13	0.02	0.00	0.00	0.00	0.00	0.00	0.00		
	P2																										

* No monthly summary was computed for the ranges.

PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)
P3 - Precipitation under drip canopy (in.)
P4 - Precipitation under open canopy (in.)

PS - Precipitation at 1.0 m. in open area (in.)
P1 - Precipitation at 46.0 m. above canopy (in.)
P2 - Precipitation under full canopy (in.)

2. Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary					
		Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Days	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	5	6	6	6	6	6	6	6	6	6	5	6	7	7	9	8	8	8	7	7	7	7	6	6	6	5	631	0	6	17
	28.5 m																														
	26.5 m	3	2	2	2	2	2	1	2	3	3	4	4	4	4	4	3	4	3	3	3	2	2	2	3	3	2	449	0	3	12
	13.5 m																														
	8.0 m																														
	4.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	669	0	0	6
	2.0 m																														
	1.0 m																														
	0.5 m																														

Chiva Chiva (Open site)	46.0 m		5	4	5	4	4	4	5	4	5	6	5	7	7	8	8	9	7	8	8	8	7	6	5	6	5	371	0	6	18
	28.5 m																														
	26.5 m		4	3	3	3	4	3	4	3	4	5	5	7	6	8	8	8	8	7	7	5	5	4	4	5	4	575	0	5	21
	13.5 m		2	1	2	1	1	1	1	1	1	3	3	4	4	5	5	7	6	6	6	5	4	4	3	2	2	733	0	3	18
	8.0 m																														
	4.0 m		3	2	2	2	2	3	2	2	3	5	5	6	5	6	7	7	6	6	5	4	3	3	2	3	3	673	0	4	14
	2.0 m		1	0	1	0	0	0	0	0	1	1	1	2	2	3	3	4	4	3	3	2	2	1	1	1	1	734	0	2	12
	1.0 m																														
	0.5 m																														

Note: Data at 46.0 meters represent the first 21 days of the month only.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JULY 1967

Exposure		Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*	
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albrook (Forest site)	46.0 m	9	12	11	5	10	11	11	10	11	13	16	11	11	12	10	16	10	13	12	13	10	11	10	11		
	28.5 m	This level was not instrumented for wind speed at this time																									
	26.5 m	6	4	6	4	5	5	5	6	7	9	12	9	7	9	7	8	8	7	7	5	5	8	7	5		
	13.5 m	This level was not instrumented for wind speed at this time																									
	8.0 m	This level was not instrumented for wind speed at this time																									
	4.0 m	0	1	3	2	1	6	1	1	2	2	1	2	2	2	2	2	1	1	1	1	1	1	1	0		
	2.0 m	This level was not instrumented for wind speed at this time																									
	1.0 m	This level was not instrumented for wind speed at this time																									
	0.5 m	This level was not instrumented for wind speed at this time																									

* No monthly summary was computed for the ranges.

China Chiva (Open site)	46.0 m	12	8	8	7	12	11	10	8	10	11	14	14	14	11	13	9	10	11	8	11	7	8	12	10		
	28.5 m	This level was not instrumented for wind speed at this time																									
	26.5 m	13	14	13	6	8	16	6	6	7	7	11	13	19	10	14	11	9	12	9	9	7	8	9	7		
	13.5 m	10	10	10	5	5	6	4	5	8	7	12	13	18	11	12	10	10	10	8	9	8	7	9	8		
	8.0 m	This level was not instrumented for wind speed at this time																									
	4.0 m	7	7	7	5	5	14	6	5	7	8	11	11	11	9	10	9	11	9	6	7	6	6	7	6		
China Chiva (Open site)	2.0 m	5	5	4	3	3	4	1	3	5	5	7	8	10	7	12	8	8	7	5	5	4	4	5	3		
	1.0 m	This level was not instrumented for wind speed at this time																									
	0.5 m	This level was not instrumented for wind speed at this time																									

Note: Data at 46.0 meters represent the first 21 days of the month only.

ALBROCOK (Forest site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m.

Relative Frequencies* of Wind Directions by Hour at 46.0 m.																									
		(%)																							
Hr.	Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	N	3.4	3.4	3.4	3.4	3.4			3.4	3.3	3.3	3.3	10.0			6.4	10.0	13.7	13.7	10.3	3.4	10.7	6.8	10.3	3.5
NNE	NNE						3.4					3.3		3.3	3.3	3.2	10.0	6.8			3.5	3.4		3.5	
NE	NE					3.4		3.4					3.3		3.3	3.2	3.3	10.3	3.4			3.5	3.4	3.5	
ENE	ENE		3.4						3.3						3.3		3.3	6.8						3.4	
E	E	3.4						3.4		3.3			3.3			9.7			3.4						
ESE	ESE						3.4		3.3																
SE	SE					3.4								3.3	3.3			6.8						3.5	
SSE	SSE						3.4		3.3	3.3				3.3	6.6		6.6								
S	S								3.3			6.6	10.0	10.0	10.0	9.7									
SSW	SSW							3.4			6.6	6.6	3.3												
SW	SW	3.4	3.4	3.4			3.4		3.3	3.3	3.3	3.3	3.3	3.3	6.6										
WSW	WSW	3.4			10.3	3.4		17.1		10.0		6.6	20.0	13.3	10.0			3.4	10.3		3.5			3.5	
W	W	17.1	3.4	6.8	10.3	10.3	17.1	3.4	20.0	20.0	13.3	6.6	20.0	26.6	6.6	12.9	26.6	20.6	13.7	13.7	6.8	17.7	13.7	6.8	
WNW	WNW	27.3	41.0	20.6	20.6	20.6	24.0	24.0	20.0	13.3	29.9	20.0	10.0	6.6	10.0	22.6	13.3	10.3	3.4	17.1	30.7	21.3	17.1	30.7	
NW	NW	13.7	27.3	34.1	41.0	34.1	34.1	27.3	23.3	13.3	23.3	23.3	6.6	20.0	20.0	29.0	29.0	20.6	41.0	34.1	34.1	17.7	37.6	34.1	
NNW	NNW	20.5	10.3	27.3	13.7	10.3	6.8	6.8		20.0	10.0	16.6	10.0	10.0	16.6	3.2	6.6		17.1	10.3	17.1	10.3	14.2	6.8	
CALM	CALM	6.8	6.8	3.4		10.3	3.4	10.3	16.6	10.0	10.0	3.3							3.4	3.4	6.8	7.0	6.8	7.0	

* Note: Due to rounding, percentage totals do not equal 100%.

IMPERIORE E A 05001

ALBROOK (Forest site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 m. (%)																									
Dir	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N	15.4	11.5	7.6	7.6	7.6	3.8	7.3	7.0	14.2	6.8	3.5	10.7	7.0	3.5	6.0	10.3	7.0	7.0	14.2	10.7	11.0			3.8	16.0
NNE		3.8				3.8			3.5	3.4	7.0		3.5		3.3	10.3	7.0	3.5	3.5	1.7	3.6				
NE	3.8									3.4	3.5	3.5	3.5		6.6	3.4	10.7	3.5			3.6			4.0	
ENE																									
E						3.8	3.6	3.5			3.5					6.8	3.5								
ESE													3.5		3.3		3.5	3.5			3.6			4.0	
SE						3.8					3.5		3.5	10.7	3.3		3.5								
SSE								3.5					3.5	10.7	6.6	3.4									
S				3.8			3.6			3.4	3.5	3.5	10.7		6.6						3.5	3.6			
SSW											3.5	3.5							3.5						
SW	3.8				3.8			3.5	3.5		7.0	14.2	14.2	3.5					3.5				3.8		
WSW				3.8	3.8				7.0	3.4	3.5	7.0	3.5	10.7		3.4			3.5					4.0	
W	3.8	3.8				3.8	3.6			10.3	3.5	10.7	7.0	7.0			10.7			3.5	7.3	10.7			
WNW	7.6	15.4	7.6	7.6	11.5	7.6	7.3	21.3	10.7	13.7	10.7	10.7	7.0	14.2	16.6	17.1	7.0	3.5	7.0	3.5	11.0	7.0	11.5		
NW	30.7	26.9	38.3	7.6	30.7	26.9	18.4	24.9	28.4	24.0	10.7	14.2	7.0	14.2	26.6	30.7	24.9	39.0	31.9	24.9	11.0	31.9	26.9	32.0	
NNW	23.1	30.7	30.7	46.0	19.1	26.9	22.1	14.2	17.7	10.3	24.9	10.7	17.0	14.2	10.0		7.0	21.3	17.7	17.7	7	24.9	34.5	28.0	
CALM	11.5	7.6	15.4	19.1	23.1	19.1	33.1	21.3	14.2	20.6	10.7	10.7	7.0	10.7	10.0	13.7	14.2	17.7	17.7	21.3	14.7	24.9	19.1	12.0	

* Note: Due to rounding, percentage totals do not equal 100%

IMPERIAL S. A. 1967

ALBROOK (Forest site) JULY 1967

Relative Frequencies* of Wind Directions by Hour at 4.0 m.																								
Hr. Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N					3.8	3.8			3.8	3.8	3.8	3.8	3.8	3.8	7.3		4.0	7.9	4.0				4.0	
NNE																7.6	7.9							
NE			3.6					3.8			7.6	3.8			3.6						4.0			
ENE																						4.0		
E									3.8			3.8	3.8											
ESE	3.6																							
SE																								
SSE																								
S		3.6				3.8				3.8						3.8		4.0	4.0				4.0	
SSW										3.8										4.0				
SW								3.8		3.8	3.8		7.6	3.8	3.6	3.8	4.0	4.0	4.0					
WSW									3.8	7.6	3.8	3.8					4.0							
W									7.6		11.5		7.6	3.8	3.6	7.6	4.0	4.0						
WNW									3.8	3.8					7.3			4.0		4.0				4.1
NW				3.8	3.8	3.8	4.0	7.6			3.8	3.8		11.5		3.8		4.0	4.0	7.9	4.0			
NNW				3.8	3.8		4.0		3.8	3.8	3.8	3.8	3.8		11.0	3.8	7.9		7.9			4.0		
CALM	95.6	91.9	84.5	92.1	92.1	88.3	92.0	84.5	65.2	72.9	72.9	76.8	72.9	72.9	62.5	69.1	58.0	72.0	76.0	84.0	92.0	92.0	92.0	95.7

* Note: Dg. percentage totals do not equal 100%.

CHIVA CHIVA (Open site) JULY 1967

		Relative Frequencies* of Wind Directions by Hour at 46.0 m. (%)																							
Dir.	Hz.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	11.7	5.9								4.8					5.0	5.0	5.0	5.0		5.0			15.0	16.7	16.7
NNE																									
NE											4.8														
ENE						6.3			4.8								5.0	5.0							
E						5.9			4.8	9.5									5.0						
ESE														5.0			5.0								
SE														5.0	5.0	10.0			5.0						
SSE									4.8			4.8		5.0											
S										4.8															
SSW																									
SW									4.8				5.0	5.0	5.0				5.0						
WSW						6.3			4.8	4.8	4.8	9.5	10.0		5.0							5.0			5.6
W	17.6				5.9	6.3	5.9	23.8	4.8	23.8		9.5	10.0	20.0	5.0	10.0		5.0			5.0		5.0	5.0	5.6
WNW	29.3	29.3	11.7	41.0	18.7	29.3	23.8	23.8	47.6	33.3	23.8	19.0	15.0	25.0	35.0	30.0	20.0	20.0	20.0	15.0	30.0	25.0	15.0		11.1
NW	23.4	52.8	58.5	35.2	43.6	46.9	23.8	28.6	19.0	52.4	38.1	40.5	20.0	25.0	35.0	35.0	55.0	40.0	45.0	65.0	60.0	55.0	50.0	50.8	38.9
NNW	5.9		17	11.7	6.3	11.7	19.0	9.5	4.8	4.8		9.5	15.0	20.0	10.0	10.0		25.0	25.0	10.0	5.0	20.0	10.0	22.2	11.1
CALM	11.7	11.7	11.7	11.7	5.9	12.4		9.5	4.2															5.6	11.1

* Note: Due to rounding, percentage totals do not equal 100%

CHIVA CHIVA (Open site) JULY 1967

		Relative Frequencies* of Wind Directions by Hour at 26.5 m. (%)																							
Dir.	Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N		12.9	12.9	16.1	6.6	16.6	3.3	6.4	9.7	3.2	6.4	9.7	6.4	22.6	3.2	6.4	3.2	16.1	16.1	12.9	9.7	16.1	9.7	3.3	10.3
NNE		3.2	3.2	6.4	3.3	3.3	3.3		3.2		3.2		3.2		3.2	6.4	3.2				3.2	3.2	3.2	6.6	6.8
NE		3.2	3.2		3.3					6.4	3.2				6.4		6.4		3.2	3.2		3.2	3.2	3.3	
ENE							3.3	3.2	3.2	3.2		3.2											6.4		
E						6.6	6.6	6.4	3.2	3.2	3.2	6.4			3.2		3.2	3.2	3.2			3.2			4
ESE						3.3						3.2	3.4			3.2	3.2		3.2						
SE			3.2									3.2		6.4		9.7	9.7	3.2		3.2			3.2		
SSE									3.2			3.2		3.2	3.2										
S					3.3								3.2		3.2				3.2	3.2					3.4
SSW								3.2	3.2																
SW		3.2	3.2	6.4			3.3	6.4	3.2	3.2		3.2	6.4		9.7							3.2	3.2		3.4
WSW		3.2	3.2		3.3		3.3	6.4		6.4	6.4	6.4		6.4	6.4		3.2	3.2	3.2				3.2	6.6	
W		12.9	3.2	3.2	3.3	6.6	13.3	9.7	16.1	6.4	3.2	9.7	12.9	12.9	9.7	9.7	3.2	3.2	6.4		3.2	3.2	6.4	13.7	
WNW		9.7	12.9		20.0		16.6	12.9	22.6	25	12.9	9.7	9.7	12.9	12.9	15.4	6.4	9.7	6.4	6.4	9.7	12.9		3.3	13.7
NW		16.1	22.6	25.8	23.3	39.9	20.6	17.9	19.4	29.1	38.7	22.6	19.4	22.6	25.8	32.2	38.7	32.2	22.6	41.9	41.9	32.2	35.5	20.0	24.0
NNW		19.4	16.1	22.6	23.3	13.3	20.0	19.4	12.9	12.9	22.6	16.1	29.0	12.9	12.9	12.9	19.4	29.0	32.2	25.0	29.0	22.6	22.6	53.1	20.6
CALM		16.1	16.1	19.4	10.0	10.0	6.6	12.9				3.2	6.4								3.2		3.2		

* Note: Due to rounding, percentage totals do not equal 100%.

CHIVA CHIVA (Open site) JULY 1967

		Relative Frequencies* of Wind Directions by Hour at 4.0 m.																							
Dir.	Hr.	(%)																							
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	24.0	10.3	17.1	6.8	14.2	13.7	6.4	6.4			16.1	16.1		19.4	6.4	9.7	6.4	16.1	16.1	6.4	29.0	12.9	13.3	16.6	
NNE		6.8	3.4	3.4	7.0	3.4				3.2		3.2	3.2		6.4	3.2	3.2	6.4			3.2	6.4			
NE	10.3	13.7	6.8	10.3		3.4	6.4	6.4	3.2	6.4					3.2		3.2		3.2		3.2	6.4	3.3	6.6	
ENE	3.4					6.8	3.2	3.2	3.2		5.2	3.2							3.2			3.2	6.6		
E	3.4			6.6	3.4	3.5	6.8	3.2	3.2	3.2	3.2	3.2		6.4		3.2	6.4				3.2	3.2		3.3	
ESE						3.4	6.4									3.2	3.2	6.4	3.2			6.4	3.3		
SE													3.2		3.2	3.2	6.4	6.4	3.2		3.2				
SSE						3.5									3.2	3.2	3.2				3.2	3.2			
S						3.5	6.8					3.2	3.2	3.2	5.4	3.2				3.2			3.3	3.3	
SSW								3.2	3.2				3.2								3.2				
SW		3.4			6.8	3.5		3.2	3.2	9.7		9.7	9.7	6.4	9.7		3.2		6.4			3.2			
WSW	3.4				6.8		3.4	3.2	9.7	3.2	3.2	3.2	6.4	6.4	6.4	3.2		3.2						3.3	
W	3.4	6.8	6.8	6.8	7.0	6.8	12.9	12.9	12.9	12.9	9.7	9.7	9.7	9.7	9.7	19.4	9.7	16.1	9.7	19.4	6.4	16.1	10.0	16.6	
WNW	13.7	3.4	10.3	10.3	3.5	10.3	19.4	16.1	16.1	16.1	29.0	6.4	9.7	9.7	16.1	19.4	19.4	9.7	12.9	12.9	16.1	6.4	9.7	3.3	3.3
NW	20.6	15.7	27.3	17.1	21.3	13.7	16.1	22.6	25.8		22.6	29.0	32.2	29.0	22.6	22.6	19.4	25.8	25.8	29.0	29.0	35.5	17.9	20.0	20.0
NNW	10.3	17.1	10.3	10.3	21.3	13.7	6.4	16.1	16.1		12.9	12.9	19.4	6.4	6.4	9.7	16.1	16.1	16.1	19.4	25.8	16.1	16.1	20.0	
CALM	6.8	24.0	10.3	17.1	10.7	6.8	12.9			3.2												3.2	10.0	6.6	

* Note: Due to rounding, percentage totals do not equal 100%.

IMPRESORA S. A. 1967

SUMMARY OF NON HOURLY DATA

JULY 1967

Summary of Elements with Non-hourly Frequencies of Observations						
Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Altbrook (forest site)	WBGIT Index ¹ (at 1.0 meters)	Index value	434	70.5	77.0	82.8
		Dry bulb temp.	434	70.5	77.9	86.0
		Wet bulb temp.	434	70.3	76.5	82.0
		Black bulb temp.	434	71.0	78.5	88.0
	Evaporation ³ (in. at 4 levels)	Piche (46.0 m)	29	0.043	5.921*	0.470
		Piche (26.5 m)	28	0.043	5.392*	0.518
		Piche (13.5 m)	27	0.006	1.641*	0.140
		Piche (0.5 m)	26	0.006	0.814*	0.085
	Precipitation from Raingauge Network ² (in. at 1.0 meters)	Gauge # 1	27	0.01	5.18*	1.04
		Gauge # 2	28	0.01	8.44*	1.10
		Gauge # 3	28	0.01	8.41*	1.23
		Gauge # 4	27	0.01	8.39*	1.26
		Gauge # 5	28	0.01	7.24*	1.20
		Gauge # 6	28	0.01	7.34*	1.05
		Gauge # 7	28	0.01	8.01*	1.25
		Gauge # 8	28	0.01	7.17*	1.15
	Stem Flow ² (in. at 2.0 meters)	Small tree	26	0.01	8.81*	2.00
		Medium tree	23	0.01	9.32*	2.00
		Large tree	20	0.01	39.75*	11.49
Chiva Chiva (Open site)	WBGIT Index ¹ (at 1.0 meters)	Index value	432	69.8	79.7	89.6
		Dry bulb temp.	432	70.0	80.5	94.8
		Wet bulb temp.	432	69.8	77.0	83.3
		Black bulb temp.	432	70.0	88.6	118.1
	Evaporation ³ (in. at 0.5 meters)	Piche	31	0.006	4.025*	0.482
		Pan	27	0.021	3.653*	0.287
	Minimum Grass temp ³ (°F at grass tips)	None	29	67.5	70.7	74.0

* Total Values

- 1 - Hourly observations between 0600 and 1900 hours inclusive
- 2 - Six hourly observations
- 3 - Daily observations

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<p>This report contains detailed microclimatic data for July 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.</p>			

KEY WORDS

LINK A

LINK B

LINK C

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